Attorney Docket No. P16936-US4
Customer Number 27045

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims

1. (Currently Amended) A phase modulator, comprising:

a phase-locked loop having a phase frequency detector, a low-pass modulation input coupled to the phase frequency detector, a voltage controlled oscillator, and a high-pass modulation input coupled to the voltage controlled oscillator; and

a trimming circuit connected between the phase frequency detector and the voltage controlled oscillator, the trimming circuit configured to receive an error signal from the phase frequency detector and to control a gain of the high-pass modulation input such that the high-pass modulation input and the low-pass modulation input together form an all-pass modulation input to the voltage controlled oscillator.

2. (Original) The phase modulator of claim 1, wherein the trimming circuit is configured to apply an estimate of the gain of the voltage controlled oscillator to the voltage controlled oscillator.

3. (Withdrawn) The phase modulator of claim 1, wherein the phase frequency detector comprises a first charge pump and a second charge pump, and the error signal comprises a feedback component from the first charge pump and a gain control component from the second charge pump.

4. (Currently Amended) ~~The phase modulator of claim 1, further comprising~~ A phase modulator, comprising:

a phase-locked loop having a phase frequency detector, a low-pass modulation input coupled to the phase frequency detector, a voltage controlled oscillator, and a high-pass modulation input coupled to the voltage controlled oscillator; and

a trimming circuit connected between the phase frequency detector and the voltage controlled oscillator, the trimming circuit including a loop filter ~~in the trimming circuit~~ configured to control a dynamic behavior of the trimming circuit, wherein the trimming circuit is configured to receive an error signal from the phase frequency detector and to control a gain of the high-pass modulation input such that the high-pass modulation input and the low-pass modulation input together form an all-pass modulation input to the voltage controlled oscillator.

5. (Withdrawn) The phase modulator of claim 4, wherein the compensation circuit is located in parallel with the loop filter.

6. (Currently Amended) The phase modulator of claim 4, wherein the ~~compensation~~ trimming circuit is located after the loop filter.

7. (Currently Amended) ~~The phase modulator of claim 1, further comprising~~ A phase modulator, comprising:

a phase-locked loop having a phase frequency detector, a low-pass modulation input coupled to the phase frequency detector, a voltage controlled oscillator, ~~and~~ a high-pass modulation input coupled to the voltage controlled oscillator, and a variable amplifier coupled to the voltage controlled oscillator for introducing an estimation of the gain of the voltage controlled oscillator to the voltage controlled oscillator based upon a center frequency of a desired output signal of the voltage controlled oscillator; and

a trimming circuit connected between the phase frequency detector and the voltage controlled oscillator, the trimming circuit configured to receive an error signal from the phase frequency detector and to control a gain of the high-pass modulation input such that the high-pass modulation input and the low-pass modulation input together form an all-pass modulation input to the voltage controlled oscillator.

8. (Withdrawn) The phase modulator of claim 7, wherein the voltage controlled oscillator has a separate modulation input for receiving an output of the variable amplifier.

9. (Original) The phase modulator of claim 1, further comprising an adder for combining the low-pass modulation input and the high-pass modulation input.

10. (Currently Amended) ~~The phase modulator of claim 1,~~ A phase modulator, comprising:

a phase-locked loop having a phase frequency detector, a low-pass modulation input coupled to the phase frequency detector, a voltage controlled oscillator, and a high-pass modulation input coupled to the voltage controlled oscillator; and

a trimming circuit connected between the phase frequency detector and the voltage controlled oscillator, the trimming circuit configured to receive an error signal from the phase frequency detector and to control a gain of the high-pass modulation input such that the high-pass modulation input and the low-pass modulation input together form an all-pass modulation input to the voltage controlled oscillator, wherein the trimming circuit comprises:

a loop voltage amplifier configured to amplify the error signal upon receipt of a start signal;

a delay and limit section configured to delay and limit a modulation signal provided to the high-pass modulation input;

a mixer configured to mix the amplified error signal with the delayed and limited modulation signal; and

an integrator configured to integrate the mixed signal, wherein the integrated mixed signal is used to control a gain of the modulation signal provided to the high-pass modulation input.

11. (Original) The phase modulator of claim 10, wherein loop voltage amplifier includes a low-pass filter configured to filter the error signal and a differential amplifier configured to amplify the filtered error signal.

12. (Original) The phase modulator of claim 11, wherein the loop voltage amplifier further includes a transconductance cell in a feedback path of the differential amplifier, and wherein switching a transconductance of the transconductance cell between a high value and a low value transforms the differential amplifier into a bandpass amplifier.

13. (Original) The phase modulator of claim 1, wherein the phase modulator is configured to be used in an Enhanced Data GSM Environment communication system.

14. (Original) The phase modulator of claim 1, wherein the phase modulator is configured to be used in a Wideband Code Division Multiple Access communication system.

15. (Original) In a phase modulator having a phase-locked loop that includes a phase frequency detector, a low-pass modulation input coupled to the phase frequency detector, a voltage controlled oscillator, a high-pass modulation input coupled to the voltage controlled oscillator, and a trimming circuit, a method of controlling a gain of the voltage controlled oscillator, comprising:

receiving an error signal from the phase frequency detector in the trimming circuit; and

controlling a gain of the high-pass modulation input using the trimming circuit and the error signal such that the high-pass modulation input and the low-pass modulation input together form an all-pass modulation input to the voltage controlled oscillator.

16. (Original) The method of claim 15, further comprising applying an estimate of the gain of the voltage controlled oscillator to the voltage controlled oscillator.

17. (Original) The method of claim 15, wherein the step of receiving an error signal comprise receiving a feedback component of the error signal and a gain control component of the error signal.

18. (Original) The method of claim 15, further comprising filtering the received error signal to control a dynamic behavior of the trimming circuit.

19. (Withdrawn) The method of claim 18, wherein the error signal is by the trimming circuit after it has been filtered.

20. (Withdrawn) The method of claim 18, wherein the error signal is by the trimming circuit before it has been filtered.

21. (Original) The method of claim 15, further comprising introducing an estimation of the gain of the voltage controlled oscillator to the voltage controlled oscillator based upon a center frequency of a desired output signal of the voltage controlled oscillator using.

22. (Withdrawn) The method of claim 21, wherein the voltage controlled oscillator has a separate modulation input for receiving the estimation of the gain of the voltage controlled oscillator.

23. (Original) The method of claim 15, further comprising combining the low-pass modulation input and the high-pass modulation input.

24. (Original) The method of claim 15, wherein the step of controlling the gain of the high-pass modulation input comprises: amplifying the error signal upon receipt of a start signal; delaying and limiting a modulation signal provided to the high-pass modulation input; mixing the amplified error signal with the delayed and limited modulation signal; and integrating the mixed signal, wherein the integrated mixed signal is used to control a gain of the modulation signal provided to the high-pass modulation input.

25. (Original) The method of claim 24, wherein the step of amplifying the error signal includes low-pass filtering the error signal and differentially amplifying the error signal.

26. (Original) The method of claim 25, the step of amplifying the error signal further includes transforming the error signal into a bandpass signal.

27. (Original) The method of claim 15, wherein the method is used in an Enhanced Data GSM Environment communication system.

28. (Original) The method of claim 15, wherein the method is used in a Wideband Code Division Multiple Access communication system.

29. (Original) A phase-locked loop, comprising:

a phase frequency detector;

a voltage controlled oscillator; and

a trimming circuit connected between the phase frequency detector and the voltage controlled oscillator, the trimming circuit configured to receive an error signal from the phase frequency detector and to control a gain of the voltage controlled oscillator based on the error signal and an estimation of the gain of the voltage controlled oscillator.